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10/712,575	11/13/2003	Vijav Narayanan	YOR920030438US1	8789

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EXAMINER

HU, SHOUXIANG

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 11/15/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/712,575

Applicant(s)

NARAYANAN ET AL.

Examiner

Shouxiang Hu

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 26 August 2004.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-35 is/are pending in the application.
- 4a) Of the above claim(s) 1-7 and 22-32 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 8-21 and 33-35 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 November 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 20040702.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Election/Restrictions*

1. Claims 1-7 and 22-32 withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 20040826.

### *Drawings*

2. The drawings are objected to because what shown in Fig. 3 appears to be in error. The legend for the vertical axis in Fig. 3 includes the term of "Si (or N)/Si+Ta+N"; but the content ratio of any individual element to the total elements in the whole compound should not be larger than 1. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to

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obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

### ***Claim Objections***

3. Claims 8-21 and 33-35 are objected to because of the following informalities and/or defects:

In claims 8 and 33, the term of "0.9" for the ratio should be read as: --0.9:1--.

Claims 12 and 27 each recite the subject matter that the Si to Ta elemental ratio in the recited TaSiN is between about 0.35 and 0.5; but, according to the specification (see lines 5-9 on page 7), it should be the Si content ratio with respect to the recited TaSiN that is between about 0.35 and .5.

Appropriate correction is required.

### ***Claim Rejections - 35 USC § 102***

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

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5. Claims 8-11 and 15-19, as being best understood in view of the claim objections, are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Grant (6,423,619).

Grant discloses a semiconductor field effect device (Fig. 6; also see col. 2, line 53 through col. 3, line 14), having a gate dielectric (22; SiO<sub>2</sub> or ZrO<sub>2</sub>; can be less than 2nm in thickness) and a gate (24), wherein the gate comprises a compound of either TaN or TaSiN, which has a ratio of N:Ta about 1:1, and the resistivity of the compound therein is naturally below about 20mΩcm as the one recited in the instant invention, since the compound in Grant has a substantially same N:Ta ratio and is formed through a substantially same method (CVD) as the ones in the instant invention.

Or, in the alternative, it would have been obvious over Grant as it is art recognized that low resistivity for the gate electrode material is always desirable for reducing the gate resistance.

Regarding claim 11, the TaN in Grant naturally has a crystalline material structure.

6. Claims 8-21, as being best understood in view of the claim objections, are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Ngai (6,518,106).

Ngai discloses a semiconductor field effect device (Fig. 5; also see col. 2, line 34 through col. 3, line 9), having a gate dielectric (40; SiO<sub>2</sub> or ZrO<sub>2</sub>; can be less than 2nm in thickness) and a gate (50), wherein the gate comprises a compound of either

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Tantalum Nitride or TaSiN, which (at least in TaSiN) has a ratio of N:Ta about 1:1, and the resistivity of the compound therein is naturally below about  $20\text{m}\Omega\text{cm}$  as the one recited in the instant invention, since the compound in Ngai has a substantially same N:Ta ratio and is formed through a substantially same method (CVD) as the ones in the instant invention.

Or, in the alternative, it would have been obvious over Ngai as it is art recognized that low resistivity for the gate electrode material is always desirable for reducing the gate resistance.

Regarding claims 10 and 11, a Tantalum Nitride compound is commonly expressed as TaN in the art, which naturally covers a Ta:N ratio of about 1:1, and, when formed through CVD, naturally has crystalline structure.

Regarding claim 12, the Si content ratio in TaSiN in Ngai naturally covers a ratio substantially the same as the one in the instant invention as the TaSiN workfunction in Ngai can be adjusted in a wide range of from 4.4 eV to 4.8 eV.

Regarding claim 13, the TaSiN in Ngai is naturally amorphous.

Regarding claims 14, 20 and 21, the TaSiN gate electrode in Ngai is used in an NMOS transistor; and it naturally covers a workfunction and a threshold as recited in the instant invention, as the TaSiN workfunction in Ngai can be adjusted in a wide range of from 4.4 eV to 4.8 eV.

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 33-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ngai.

The disclosure of Ngai is discussed as applied to claims 8-21 above.

Although Ngai does not expressly disclose that the field effect transistor can be used in a processor, it is noted that one of ordinary skill in the art would readily recognize that field effect transistors are widely and commonly used in devices such as digital processors and processors having analog circuits for achieving high performance and low power consumption in these devices.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the field effect transistors of Ngai into devices of digital processor and/or processors having analog circuits therein, electronic device with high performance and low power consumption would be obtained.

***Conclusion***

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. References C-F are cited as being related to a field effect transistor structure.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shouxiang Hu whose telephone number is 571-272-1654. The examiner can normally be reached on Monday through Thursday, 7:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on 571-272-1732. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

SH

November 9, 2004



**SHOUXIANG HU**  
**PRIMARY EXAMINER**